WHAT IS CLAIMED IS:

1. A system for catalytically treating a gas stream, which comprises:

a) a gas phase reactor containing a catalyst for the treatment of the gas stream in at least one catalyst bed having an upstream end and a downstream end;

b) an axial fan positioned upstream of the at least one catalyst bed and having a rotatable impeller for moving the gas stream through the gas phase reactor; and,

c) gas flow modification means positioned between the impeller and the gas phase reactor for decreasing gas stream velocity and increasing gas flow uniformity.

2. The system of claim 1 wherein the gas flow uniformity is increased by the gas flow modification means such that the gas stream entering the gas phase reactor has a velocity profile exhibiting not more than about 10% velocity deviation from an average gas stream velocity at the upstream end of the at least one catalyst bed.

3. The system of claim 2 wherein the velocity profile of the gas stream exhibits no more than about a 5% velocity deviation from an average gas stream velocity at the upstream end of the at least one catalyst bed.

4. The system of claim 1 wherein the axial fan includes a housing and a tail cone, and the gas flow modification means includes a distally pointing tapered end portion of the tail cone and a flared portion of the housing having a gradually increasing diameter.

5. The system of claim 4 wherein the gas flow modification means further includes a transition duct having perforated walls which flare outward so as to gradually increase cross-sectional area available to gas stream flow.

6. The system of claim 1 wherein the gas flow modification means includes a transition duct having perforated walls which flare outward so as to gradually increase cross-sectional area available to gas stream flow.

7. The system of claim 1 further including means for recycling a portion of the gas stream from downstream of the axial fan to a position upstream of the axial fan.

8. The system of claim 1 wherein the gas stream contains nitrogen oxide.

9. The system of claim 1 wherein the catalyst bed includes a plurality of stackable, individually separable modules containing one or more materials selected from the group consisting of vanadium oxide, aluminum oxide, titanium oxide, tungsten oxide, molybdenum oxide and zeolite.

10. The system of claim 9 wherein the modules each comprise a plurality of stacked catalyst elements having a honeycomb type structure.

11. The system of claim 1 wherein the catalyst bed comprises a catalyst supported on a mesh-like structure having a void space of at least about 85%.

12. The system of claim 1 wherein the catalyst bed includes a vanadium pentoxide catalyst on titanium oxide support.

13. The system of claim 1 wherein the gas phase reactor comprises at least two catalyst beds arranged in series.

14. The system of claim 1 wherein the fan impeller includes a plurality of blade units attached to and extending radially outward from a circumferential periphery of the impeller.

15. The system of claim 14 wherein the blade units each comprise two blades.

16. The system of claim 14 wherein the blade units have a variable pitch which is controllable while the impeller is rotating.

17. The system of claim 14 wherein the impeller has a variable speed of rotation which is adjustable while the impeller is rotating.

18. The system of claim 1 further including a heat recovery section positioned downstream of the gas phase reactor for cooling the gas stream.

19. The system of claim 1 further including means for introducing reducing agent into the gas stream.

20. The system of claim 19 further including a gas stream recycle manifold for communicating a portion of the gas stream downstream of the axial fan to a convection section of a furnace positioned upstream of the axial fan, wherein the means for introducing reducing agent comprises an inlet for introducing the reducing agent into the gas stream recycle manifold.

21. A system for catalytically treating a furnace flue gas, which comprises:

a) a gas phase reactor containing a catalyst for the treatment of the flue gas in at least one catalyst bed having an upstream end and a downstream end;

b) an axial fan positioned upstream of the at least one catalyst bed and downstream of a furnace and

having a rotatable impeller for moving the flue gas from the furnace through the gas phase reactor; and,

c) means for recycling a portion of the flue gas from downstream of the axial fan to a convection section of the furnace located upstream of the axial fan.

22. The system of claim 21 wherein the means for recycling a portion of the flue gas comprises a gas stream recycle manifold.

23. The system of claim 22 wherein the gas stream recycle manifold includes an inlet for introducing reducing agent into recycle manifold.

24. The system of claim 22 wherein the gas stream recycle manifold includes a control valve.

25. The system of claim 22 further comprising a transition duct having perforated walls which flare outward so as to gradually increase cross-sectional area available to flue gas flow.

26. The system of claim 25 wherein the gas stream recycle manifold has at least one inlet connected to the transition duct, and at least one outlet connected to the convection section of the furnace.

27. The system of claim 21 wherein the axial fan includes a housing and a tail cone, the housing having a flared distal portion and the tail cone having a distally pointing tapered end portion.

28. The system of claim 21 wherein the catalyst bed includes a plurality of stackable, individually separable modules containing one or more materials selected from the group consisting of vanadium oxide, aluminum oxide, titanium oxide, tungsten oxide, molybdenum oxide and zeolite.

29. The system of claim 28 wherein the modules each comprise a plurality of stacked catalyst elements having a honeycomb type structure.

30. The system of claim 21 wherein the catalyst bed comprises a catalyst supported on a mesh-like structure having a void space of at least about 85%.

31. The system of claim 21 wherein the flue gas contains nitrogen oxide.

32. The system of claim 31 wherein the at least one catalyst bed includes a vanadium pentoxide catalyst on titanium oxide support.

33. The system of claim 21 wherein the gas phase reactor comprises at least two catalyst beds arranged in series.

34. The system of claim 21 wherein the fan impeller includes a plurality of blade units attached to and extending radially outward from a circumferential periphery of the impeller.

35. The system of claim 34 wherein the blade units each comprise two blades.

36. The system of claim 34 wherein the blade units have a variable pitch which is controllable while the impeller is rotating.

37. The system of claim 34 wherein the impeller has a variable speed of rotation which is adjustable while the impeller is rotating.

38. The system of claim 21 further including a heat recovery section positioned downstream of the gas phase reactor for cooling the flue gas.

39. A method for catalytically treating a gas stream comprising:

a) moving the gas stream through an axial fan from an upstream position to a downstream position;

b) modifying the gas stream flow from the axial fan to decrease gas flow velocity and increase gas flow uniformity;

c) recycling a portion of the gas stream from downstream of the axial fan to a position upstream of the axial fan; and,

d) passing the gas stream through a gas phase reactor having at least one catalyst bed.

40. The method of claim 39 wherein the gas flow uniformity is increased by the step of modifying the gas stream flow such that the gas stream entering the gas phase reactor has a velocity profile exhibiting not more than about 10% velocity deviation from an average gas stream velocity at the upstream end of the at least one catalyst bed.

41. The method of claim 40 wherein the velocity profile of the gas stream exhibits no more than about a 5% velocity deviation from an average gas stream velocity at the upstream end of the at least one catalyst bed.

42. The method of claim 39 further including the step of introducing a reducing agent into the recycled portion of the gas stream.

43. The method of claim 39 further including the step of cooling the gas stream after the gas stream has been passed through the gas phase reactor.

44. The method of claim 39 wherein the axial fan includes a variable speed impeller, and wherein the step of moving the gas stream through the axial fan is controlled at least in part by varying the speed of the impeller.

45. The method of claim 39 wherein the axial fan includes a plurality of variable pitch blades movably attached to a circumferential periphery of the rotatable impeller, and the step of moving the gas stream is controlled at least in part by varying the pitch of the blades.

46. The method of claim 39 wherein the step of recycling a portion of the gas stream includes withdrawing the portion of the gas stream as boundary layer suction and returning the portion of the gas stream through a recycle manifold having one or more exits into a convection section of a flue gas furnace.

47. The method of claim 46 wherein the recycle manifold includes a control valve.

48. The method of claim 39 wherein the catalyst bed comprises a catalyst supported on a mesh-like structure having a void space of at least about 85%.

49. The method of claim 39 wherein the catalyst bed includes a vanadium pentoxide catalyst on titanium oxide support.